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Southern New England-Mid-Atlantic Bight Windowpane Flounder

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a. Background

No stock structure information is available. Therefore, a provisional arrangement has been adopted that recognizes two stock areas based on apparent differences in growth, sexual maturity, and abundance trends between windowpane flounder from Georges Bank and Southern New England. The proportion of total landings contributed by the Mid-Atlantic area is low, so these windowpane flounder landings are combined with those from Southern New England and the two regions are assessed as the southern New England and Mid-Atlantic Bight (SNE-MAB) stock.

An age-based assessment for this stock is not possible because there is no age composition data available from either the research surveys or fishery samples. The stock has never been formally assessed as part of the SAW/SARC process. However, index-based assessments have been conducted at previous Groundfish Assessment Review Meetings (GARM). At the most recent GARM, in September 2005, the stock was assessed based on trends in relative biomass indices (stratified mean kg per tow) from the NEFSC fall surveys and relative exploitation rates (landings / NEFSC fall survey biomass index) during 1963-2004. The B_{MSY} proxy was based on the F_{MSY} proxy estimate from an AIM model and an estimated MSY value of 900 mt, derived from an ASPIC surplus production model, for the period 1963-1996. Stock status was determined from the 2002-2004 averages of the NEFSC fall survey relative biomass indices and relative exploitation rates. In 2004, the stock was overfished but overfishing was not occurring (NEFSC 2005). The rebuilding plan established by the New England fishery Management Council (NEFMC) requires that the stock be rebuilt by May of 2014.

Several major changes have been made to the current assessment, including model type and input data. Two of the research recommendations from the 2005 GARM, discard estimation and the inclusion of inshore survey strata in the calculation of survey indices are addressed herein. An index-based model (AIM), which utilizes catch and minimum population biomass estimates during 1975-2007 to compute relative exploitation rates and annual stock replacement ratios, is used to determine stock status. BRP's were re-estimated and the AIM model was also used to estimate an F_{MSY} proxy, defined as the relative fishing mortality rate (catch / NEFSC fall survey minimum population biomass index) at which the stock can replace itself. The re-estimated BRPs were derived using different survey and catch data inputs, a different time series, and different estimation method in comparison to the current BRPs.

b. The Fishery

Landings

The SNE-MAB stock boundary includes Statistical Areas 526, 533-539, 541, and 611-639. Commercial landings data are available for 1975-2007 (Table Q1, Figure Q1). During 1964 through May of 1994, commercial landings and additional fishery-related data were collected and entered into a Federal database by NMFS port agents. Since then, such data have been electronically reported by fish dealers and fishing location (statistical area) and fishing effort data related to landings are only available in the Vessel Trip Report database. As a result, the landings data and biological sampling data were allocated to Statistical Areas (SA) based on Vessel Trip Report data using the method described in Wigley et al. (2007a).

Landings of SNE-MAB windowpane flounder fluctuated between 532 mt in 1975 and 898 mt in 1982 then increased sharply to a peak of 2,065 mt in 1985 (Figure Q2, Table Q1). A directed fishery occurred for a short while, during 1984-1990, and landings ranged between 890 mt and 2,065 mt. Thereafter, landings gradually declined to 120 mt in 1995 and remained stable at this low level until 2001. During 2002-2007, landings were at the lowest levels on record and ranged between 39 mt and 85 mt. Landings in 2007 totaled 81 mt.

During most years, at least 97% of the annual landings were taken with bottom trawls. During 1988-1995, a higher percentage of the annual landings (3.9-12.8%) were taken with scallop dredges (Table Q2). With the exception of 1993-1998, a majority of the landings occurred in the first half of the year during 1975-2007 (Figure Q3). During 1993-1998, most of the landings occurred during the second half of the year. The spatial distribution of the landings varies pre- and post-1995. During 1975-1994, landings were predominately taken in SAs 526 and 537, with lesser amounts taken in 538 and 539 (Figure Q4). A majority of the pre-1995 landings were taken in southern New England with almost no landings from the Mid-Atlantic Bight region. However, after 1995, landings from southern New England declined sharply and most of the landings occurred in the Mid-Atlantic Bight region (mainly SAs 612 and 613).

<u>Discards</u>

Initial estimates of windowpane flounder discards, during 1975-2007, are provided for the large mesh bottom trawl fleet (codend mesh size ≥ 5.5 inches), small mesh groundfish fleet (codend mesh size < 5.5 inches), and the sea scallop fleets (dredge and bottom trawl combined, "limited permits" only) in Table Q1. Discards (mt) for 1989-2007 were estimated using Northeast Fisheries Observer Program (NEFOP) data and the combined ratio method described in Wigley et al. (2007b). Due to the low numbers of trips sampled by quarter, the large mesh bottom trawl and scallop dredge/trawl fleets were binned by half year to estimate discards (Table Q3). As a result, no imputations were necessary. There were no observed trips for the scallop fleets during 1989 and 1990 and only two trips in 1991. As a result, scallop dredge discards for 1989-1991 were estimated using the hindcast method described below. Discards for the small mesh groundfish bottom trawl fleet were estimated by quarter with the exception of 1993 and 1994 which were binned by half year. The discard estimate for the first half of 1994 was imputed. Due to a lack of fisheries observer data, prior to 1989 for the trawl fleets and prior to 1992 for the scallop fleet, discard estimates were hindcast back to 1975 based on the following equation:

(1) $$\hat{D}_{t,h} = \bar{r}_{c,1989-1991,h} * K_{t,h}$$

where:

$\hat{D}_{t,h}$ is the annual discarded pounds of windowpane flounder for fleet *h* in year *t*

$\bar{r}_{c,1989-1991,h}$ is an average combined D/K ratio (discarded pounds of windowpane flounder / total pounds of all species kept) for the fleet h during either 1989-1991 (for the trawl fleets) or 1992-1998 (for the scallop fleet)
$K_{t,h}$ is the total pounds of all species kept (landed) for fleet h in year t

The NEFOP database indicates that since 1994, the primary reason for discarding windowpane flounder is the lack of a market for this thin-bodied flatfish. However, trip limits were implemented beginning in November of 2004. There is no minimum size limit on landings but the length data indicate that only the largest fish are landed (fish ≥ 26 cm since 1994). During most years since 1975, windowpane discards were primarily from the large mesh bottom trawl fleet (considered as the small mesh fleet prior to 1982 when the minimum codend mesh size was less than 5.5 inches) and ranged between 44% and 92% during years when the predominate discard source (Table Q1). However, a majority of the total discards occurred in the scallop dredge/trawl fleet during 1993 and 1996-1997, ranging between 45% and 67%, and in the small mesh groundfish trawl fleet during 1989, 1992, 1994 and 2001-2002 and ranged between 46% and 69%. Recent discard estimates for 2001-2007 for the large mesh fleet, 2002-2007 for the scallop fleet, and 2004-2007 of the small mesh fleet, were more precisely estimated (CVs generally less than 38%) than the estimates prior to these time periods due to the increased number of trips sampled (Table Q4). In general, discard estimates for the large mesh fleet were the most precisely estimated and those for the small mesh groundfish fleet were the least precise.

Even during the period of the directed fishery, the landings were dwarfed by the high level of discards that occurred and were generally 2-5 times the landings (Table Q1, Figure Q2). During 1982-1991, total discards ranged between 2,838 mt and 4,510 mt. Since 1992, total discards have been much lower. However, during 2003-2007, discards from the large mesh trawl fleet have increased to 200-300 mt per year, in part, a result of the November 2004 implementation of a windowpane flounder trip limit of 1,000 lbs (100 lbs per day) when conducting a “B day” fishing trip. Discards totaled 309 mt in 2007. Precision of the total discard estimates was much higher during 2003-2007 (CVs of 14%-31%) then during 1992-2002, when CVs during most years ranged between 40% and 89% because the number of sampled trips was higher (Table Q1).

Catches

Catches of windowpane flounder increased gradually from 1,169 mt in 1975 to 1,805 in 1981 then doubled in 1982 and remained at the highest levels during 1982-1991, ranging between 3,614 mt and 5,400 mt (Table Q1, Figure Q2). After 1991, catches declined rapidly to a time series low of 181 mt in 2001, but then increased to 449 mt in 2003. During 2004-2007, catches remained fairly stable at some of the lowest levels observed, between 314 and 449 mt. Since 1994, most of the catch has been comprised of discards. In recent years (2003-2007), total discards represented 80%-89% of the catch and were primarily from the large mesh bottom trawl fleet (44-77% of the total).

c. Research Survey Data

Previous assessments incorporated NEFSC fall survey relative abundance and biomass indices (stratified mean number and kg per tow) that were derived using data from an offshore strata set (1-12 and 61-76) and that were not standardized for changes in trawl doors, vessels, and gear. However, the inshore strata comprise a substantial portion of the total windowpane flounder habitat (Figure Q5). Therefore, NEFSC fall survey indices were revised to include catches from inshore strata 2-46 and 55 and offshore strata 1-12 and 61-76 (Figure Q6). The revised survey indices were also standardized for changes in trawl doors (numbers = 1.54 and weight = 1.67), gear (numbers = 1.67 and weight = 1.37), and vessels (numbers = 0.82 and weight = 0.80). For the fall survey indices used in the assessment, door conversion coefficients (Byrne and Forrester 1991a) were applied to the 1975-1984 catches and vessel conversion coefficients (Byrne and Forrester 1991b) were applied when the R/V *Delaware II* was utilized instead of the R/V *Albatross IV*. The latter occurred both within and between surveys on an irregular basis. In order to derive an estimate of catchability (q) for the NEFSC fall survey, minimum population abundance and biomass (mt) indices were computed by multiplying the stratified mean number and kg per tow indices by the area swept by the trawl (0.0112 nmi^2) divided by the total area of all survey strata for the stock (29,789 nmi^2). The area swept by the trawl was computed by multiplying the average wingspread for the Yankee 36 net (11.07 m, H. Milliken pers. comm.) by the average distance trawled per tow (30 minutes per tow at 3.8 knots).

There are two distinct stanzas exhibited by the stock with respect to minimum population biomass indices: high biomass levels during 1979-1983 followed by a rapid decline to very low biomass levels since 1989 (Figure Q7, Table Q5). Trends in relative biomass indices are also presented for: the NEFSC spring (March) bottom trawl surveys (same strata as fall surveys); Massachusetts spring (May) and fall (September) surveys (strata 11-21); Connecticut (spring and fall, all strata in Long Island Sound); and the New Jersey (spring and fall, all strata) in Figure Q8. The indices suggest that the NEFSC spring surveys have lower catchabilities than the NEFSC fall surveys. The state surveys do not encompass the entire stock area and consist of shorter time series than the two NEFSC survey series. Thus, the trends in the state surveys may be more indicative of localized distribution patterns. Therefore, the NEFSC fall survey time series is considered the best indicator of stock relative abundance and biomass. However, these other surveys can be used to confirm NEFSC fall survey trends. For example, both the Long Island Sound (LIS) and MA fall survey biomass indices have been at some of the lowest levels observed since 1999 and 2002, respectively. The MA fall survey biomass indices declined sharply after 2004 and reached the lowest level on record in 2007. In addition, the overall declining trend in the NEFSC fall survey relative biomass indices, after 1982, is mirrored by the NEFSC spring surveys. Both the MA and LIS spring survey indices have been at the lowest observed levels since 2002.

d. Assessment Results

Annual catches and NEFSC fall survey minimum population biomass indices were used as input data to the AIM (An Index-based Model, version 2.0) software provided in version 3.0 of the NOAA Fisheries Toolbox (http://nft.nefsc.noaa.gov/). Computations conducted within the AIM software package and an explanation of the model parameters are provided in the Final Report of the Working Group on Re-evaluation of Biological Reference Points for New England groundfish (Anon 2002). An initial model run that included relative biomass indices from all of the surveys indicated that the model regression was only significant for the NEFSC fall survey indices.

Trends in annual catches and NEFSC fall survey biomass indices and three-year moving averages of relative exploitation rates (relative F), during 1975-2007, the data inputs to the AIM model, are presented in Figure Q9 and Table Q6. The model results, stock replacement ratios and the regression between ln(relative F) and ln(replacement ratio), are also presented in Figure Q9, along with the re-estimated biological reference points which are discussed in following section. Catches were highest during 1983-1991, a period when the biomass indices were declining and reached very low levels (Figure Q9A). Annual relative exploitation rates (relative F), computed as the annual catch in year *t* divided by fall survey relative biomass index in year *t*, increased rapidly between 1981 and 1990, when they reached a time series peak, then declined sharply between 1990 and 1992 then further declined to a time series low in 2001 (Figure Q9B). Relative exploitation rates increased gradually during 2001-2006 and were above the F_{MSY} proxy in 2006 and 2007. Stock replacement ratios were above 1.0 during 1980-1982 then declined sharply to a time series low in 1989 (Figure Q9C). Since then the stock has only been able to replace itself for short periods of time (1995-1996, 1998, 2001-2003). After 2001, replacement ratios declined sharply and remained been below 1.0 during 2004-2006 but have shown an increasing trend until declining slightly in 2007. The correlation between relative exploitation rates and stock replacement ratios was highly significant ($p = 0.002$) and the model results suggest that the stock can replace itself at a relative F value of 0.48 (the relative F value where the log of the replacement ratio is equal to 0, Figure Q9D). The model estimate of q for the NEFSC fall surveys was low (0.318, SE = 0.081), but not unexpected for this flat-bodied species (Table Q7). As might be expected when sampling the smoother, sandy bottom habitat of the Mid-Atlantic region, the q estimate for the southern windowpane flounder stock was slightly higher than estimated for the northern stock ($q = 0.217$, SE = 0.111). A negative trend in the standardized residuals was evident during 1983-1987, a period of increasing relative F and decreasing replacement ratios (Figure Q10).

e. Biological Reference Points

The current biological reference points are: F_{MSY} proxy = 0.98 and B_{MSY} = 0.92 kg per tow. The F_{MSY} proxy is a relative fishing mortality rate computed as landings divided by the NEFSC fall survey relative biomass index (mean kg per tow) for 1975-2000. The F_{MSY} proxy was derived using an index-based model (AIM) and computed as the relative fishing mortality rate at which the stock can replace itself. The B_{MSY} proxy was computed from the AIM F_{MSY} proxy estimate and an MSY estimate of 900 mt derived from an ASPIC surplus production model for the period 1963-1996.

There are two distinct stanzas exhibited by the stock with respect to minimum population biomass indices: high biomass levels during 1979-1983, followed by a rapid decline to very low biomass levels since 1989. As a result, reference points estimates presented at the April 2008 BRP meeting were based on two hypotheses: 1) that the stock is able to rebuild to the high biomass levels observed during 1979-1983; and 2) that the stock has shown little capacity to respond to management actions during the past two decades and will remain at the very low biomass levels observed since 1989. The BRP meeting review panel decided that the latter scenario was a more appropriate hypothesis.

The BRPs were re-estimated using data for 1975-2007 and represent survey-based proxies of minimum population biomass and relative exploitation rates (catch / NEFSC fall survey minimum population biomass index). The revised BRPs are shown in Table Q8 in relation to the 2007 values of relative F and the 2005-2007 average biomass index which were used to determine the 2007 stock status. The F_{MSY} proxy (relative F) was estimated using the AIM model and MSY was assumed based on trends in the catches and stock replacement ratios in relation to the NEFSC fall survey biomass indices. The AIM model results suggest that the stock can replace itself at a relative F of 0.48. This value represents an F_{MSY} proxy estimate for the stock. The 90% CI for the F_{MSY} point estimate (0.46, 0.61) indicate that the estimate is fairly imprecise (Table Q7). Replacement ratios estimated by the AIM model suggest that the stock has not been able to replace itself since 2004. Based on an examination of the trends in replacement ratios, during a period when catches were most precisely estimated (1989-2007), the stock appeared to be able to sustain the levels of catch that occurred during 1995-2001, but replacement ratios rapidly declined thereafter through 2004 (Figure Q9C). During 1995-2001, the median catch was approximately 500 mt and this value was considered as an MSY proxy. Division of the MSY proxy (500 mt) by the estimated F_{MSY} proxy from the AIM model (= 0.48) results in a B_{MSY} proxy of 1,000 mt. It is important to note that the re-estimated BRPs for the subject meeting cannot be compared to the current BRPs because different survey strata sets and time series were used and the revised estimates include discards. Furthermore, different estimation methods were utilized.

f. Projections

Stochastic projections were run for 2007-2014, because 2014 is the final year of the rebuilding plan, using the AIM model results for three scenarios: F status quo (F_{sq}), F_{MSY}, and $F_{rebuild}$. The 2009 catches and biomass estimates are presented in Table Q9 for each of the three projection scenarios. For all three scenarios, the 2009 projected catches are slightly lower than the 2007 catch of 390 mt.

g. Summary

The relative F value for 2007 was computed as the catch in 2007 divided by the 2005-2007 average of the NEFSC fall survey minimum population biomass index (Table Q8). The 2007 relative F value of 0.60 was higher than the F_{MSY} proxy value of 0.48, indicating that overfishing was occurring in 2007. The 2005-2007 average biomass index of 649 mt was well below the B_{MSY} proxy of 1,000 mt, indicating that the stock was also overfished in 2007.

The catches are comprised predominately of discards because a directed fishery has not existed since 1990. During 2001-2003, catches increased, but then remained at some of the lowest levels recorded during 2004-2007. Despite the low current catch levels, relative exploitation ratios gradually increased during 2002-2006 and recently were above the F_{MSY} proxy in 2006 and 2007. The stock has not been able to replace itself since 2003 because biomass indices have been at very low levels for a prolonged period of time, since 1989, and during 2004-2007 biomass indices were below the B_{MSY} proxy. In 2007, the stock was overfished and overfishing was occurring.

Sources of uncertainty include: the underestimation of total discards, because discards from vessels fishing in state waters without a Federal fishing permit are unavailable and the fact that neither the MSY nor B_{MSY} values were directly estimable using the AIM model.

h. Panel Discussion/Comments

i. References

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j. Acknowledgements

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Table Q1. Landings, discards, and catches (mt) of SNE-MAB windowpane flounder during 1975-2007. Landings and discards include data from statistical areas 526, 533-539, 541, and 611-639. Discards estimates include the large mesh (codend mesh size ≥ 5.5 inches) bottom trawl fleet, small mesh groundfish fleet (codend mesh size < 5.5 inches) and the sea scallop dredge fleet.

Year	Landings[1] (mt)	Discards (mt)					Catch (mt)
		Large mesh	Small mesh	Scallop dredge	Total	CV	
1975	681		429	59	488		1,169
1976	568		517	107	624		1,192
1977	647		478	105	583		1,230
1978	898		811	185	996		1,894
1979	633		929	142	1,070		1,704
1980	532		887	106	992		1,524
1981	883		850	72	922		1,805
1982	651	2,087	784	93	2,964		3,614
1983	798	2,830	709	141	3,681		4,478
1984	1,088	2,523	809	153	3,485		4,572
1985	2,065	2,098	602	138	2,838		4,903
1986	1,381	2,257	740	161	3,158		4,539
1987	887	2,054	760	292	3,106		3,993
1988	1,172	2,159	756	237	3,152		4,324
1989	1,121	1,347	1,861	295	3,503		4,624
1990	890	3,904	346	261	4,510		5,400
1991	817	1,940	902	292	3,133		3,950
1992	584	78	342	130	550	0.28	1,134
1993	469	152	71	180	403	0.89	872
1994	186	207	679	104	989	0.40	1,175
1995	120	210	105	52	367	0.25	486
1996	191	138	60	216	414	0.24	605
1997	116	51	23	151	224	0.44	340
1998	122	237	16	149	402	0.29	524
1999	117	258	27	124	408	0.46	526
2000	125	91	21	26	138	0.61	263
2001	135	18	21	7	47	0.53	181
2002	85	31	86	45	162	0.81	247
2003	47	310	20	71	402	0.31	449
2004	61	205	76	40	320	0.19	381
2005	39	123	50	103	275	0.17	314
2006	56	300	33	72	405	0.15	461
2007	81	178	61	70	309	0.14	390

[1] Since May of 2004, landings have been self-reported by dealers and were allocated to statistical area based on Vessel Trip Report data.

Table Q2. Landings (mt) of SNE-MAB windowpane flounder, by gear type, during 1975-2007.

	Landings					
Year	Bottom trawls	Sea scallop dredges/trawls	Gillnets	Other	Total	% landed by bottom trawls
1975	678.1	0.0	0.0	0.1	678	100.0
1976	563.3	0.1	0.0	0.0	563	100.0
1977	646.2	0.4	0.0	0.2	647	99.9
1978	889.5	1.2	0.0	2.1	893	99.6
1979	630.3	1.2	0.0	1.6	633	99.6
1980	523.6	0.9	0.0	0.3	525	99.8
1981	862.6	0.5	0.0	2.9	866	99.6
1982	627.6	1.1	0.0	2.6	631	99.4
1983	768.4	3.6	0.0	2.7	775	99.2
1984	1,042.4	1.7	0.0	1.1	1,045	99.7
1985	1,964.7	0.7	0.0	1.5	1,967	99.9
1986	1,356.5	20.7	0.1	0.9	1,378	98.4
1987	853.2	26.6	0.4	1.3	881	96.8
1988	1,097.8	39.3	0.0	9.8	1,147	95.7
1989	1,077.8	40.9	0.0	2.7	1,121	96.1
1990	832.9	55.2	0.1	1.7	890	93.6
1991	712.1	101.7	0.1	2.7	817	87.2
1992	512.9	68.1	0.1	2.5	584	87.9
1993	444.9	23.0	0.2	1.2	469	94.8
1994	176.9	7.6	1.3	0.1	186	95.1
1995	112.0	1.0	0.8	5.8	120	93.7
1996	189.5	0.2	0.1	1.1	191	99.3
1997	114.6	0.3	0.3	0.9	116	98.8
1998	119.7	0.0	0.5	1.6	122	98.3
1999	115.8	0.1	0.1	1.6	118	98.4
2000	121.3	0.0	0.2	3.3	125	97.2
2001	132.9	0.0	0.4	1.4	135	98.7
2002	81.5	0.0	0.2	2.0	84	97.3
2003	45.9	0.0	0.1	1.3	47	97.1
2004	57.9	0.0	0.2	2.2	60	96.0
2005	36.7	0.0	0.1	1.0	38	97.0
2006	55.1	0.1	0.5	1.3	57	96.8
2007	80.0	0.1	0.4	0.5	81	98.8

Table Q3. Number of observed trips, by fleet and quarter, included in the discard estimates of SNE-MAB windowpane flounder, 1989-2007.

	Large mesh otter trawl			Small mesh groundfish otter trawl [1]					Scallop dredge/otter trawl		
Year	Q1and Q2	Q3 and Q4	Total	Q1	Q2	Q3	Q4	Total	Q1and Q2	Q3 and Q4	Total
1989	6	4	10	13	18	21	23	75			0
1990	13	9	22	16	21	11	15	63			0
1991	10	11	21	31	21	20	46	118		2	2
1992	19	6	25	28	9	13	17	67	7	5	12
1993	4	9	13	14		4		18	11	3	14
1994	9	8	17	1		18		19	9	9	18
1995	23	49	72	13	12	30	17	72	14	8	22
1996	11	21	32	9	25	30	27	91	16	15	31
1997	9	2	11	32	13	23	3	71	13	6	19
1998	10	4	14	15	4	7	15	41	6	7	13
1999	3	5	8	11	19	12	12	54	2	6	8
2000	19	14	33	17	12	16	8	53	9	68	77
2001	10	45	55	19	17	18	13	67	43	48	91
2002	10	38	48	10	18	24	13	65	34	57	91
2003	29	19	48	16	36	23	33	108	42	61	103
2004	73	125	198	55	63	89	112	319	76	137	213
2005	141	221	362	66	50	80	77	273	71	49	120
2006	93	79	172	64	34	56	36	190	20	68	88
2007	92	172	264	41	68	95	46	250	74	108	182

[1] Trips were combined by half year during 1993 and 1994.

Table Q4. Summary of SNE-MAB windowpane flounder discard estimates (mt) for the large mesh (codend mesh size ≥ 5.5 in.) and small mesh (codend mesh size < 5.5 in.) groundfish bottom trawl fisheries and the scallop dredge/trawl fisheries (limited permit category), 1975-2007. Discards were hindcast for: large mesh bottom trawl (1982-1988); small mesh bottom trawl (1975-1988); and scallop dredges (1975-1991).

Large Mesh Bottom Trawl				
YEAR	**N Observed trips**	**D/K**	**Discards (mt)**	**CV**
1975			-	
1976			-	
1977			-	
1978			-	
1979			-	
1980			-	
1981			-	
1982			2,087	
1983			2,830	
1984			2,523	
1985			2,098	
1986			2,257	
1987			2,054	
1988			2,159	
1989	10	0.057	1,347	0.54
1990	22	0.135	3,904	0.27
1991	21	0.064	1,940	0.99
1992	25	0.002	78	0.44
1993	13	0.006	152	0.45
1994	17	0.008	207	0.51
1995	72	0.009	210	0.32
1996	32	0.006	138	0.42
1997	11	0.002	51	1.14
1998	14	0.010	237	0.46
1999	8	0.011	258	0.52
2000	33	0.005	91	0.58
2001	55	0.001	18	0.20
2002	48	0.002	31	0.25
2003	48	0.018	310	0.39
2004	198	0.010	205	0.28
2005	362	0.006	123	0.20
2006	172	0.015	300	0.19
2007	264	0.012	178	0.20

Table Q4. (cont.)

Small Mesh Groundfish Bottom Trawl				
YEAR	**N Observed trips**	**D/K**	**Discards (mt)**	**CV**
1975			429	
1976			517	
1977			478	
1978			811	
1979			929	
1980			887	
1981			850	
1982			784	
1983			709	
1984			809	
1985			602	
1986			740	
1987			760	
1988			756	
1989	75	0.0361	1,861	0.53
1990	63	0.0067	346	0.39
1991	118	0.0149	902	0.59
1992	67	0.0057	342	0.39
1993	18	0.0012	71	4.78
1994	37	0.0111	679	0.55
1995	72	0.0022	105	0.56
1996	91	0.0011	60	0.39
1997	71	0.0004	23	0.61
1998	41	0.0002	16	0.89
1999	54	0.0006	27	0.77
2000	53	0.0005	21	3.30
2001	67	0.0006	21	1.11
2002	65	0.0031	86	1.77
2003	108	0.0007	20	1.84
2004	319	0.0014	76	0.38
2005	273	0.0015	50	0.36
2006	190	0.0006	33	0.53
2007	250	0.0021	61	0.32

Table Q4. (cont.)

Scallop dredge/trawl, Limited category permits				
YEAR	N Observed trips	D/K	Discards (mt)	CV
1975			59	
1976			107	
1977			105	
1978			185	
1979			142	
1980			106	
1981			72	
1982			93	
1983			141	
1984			153	
1985			138	
1986			161	
1987			292	
1988			237	
1989			295	
1990			261	
1991			292	
1992	12	0.0020	130	0.52
1993	14	0.0057	180	0.50
1994	18	0.0022	104	0.92
1995	22	0.0010	52	0.52
1996	31	0.0051	216	0.35
1997	19	0.0052	151	0.53
1998	13	0.0056	149	0.50
1999	8	0.0034	124	1.16
2000	77	0.0003	26	0.84
2001	91	0.0001	7	0.71
2002	91	0.0003	45	0.24
2003	103	0.0004	71	0.28
2004	213	0.0003	40	0.21
2005	120	0.0010	103	0.36
2006	88	0.0009	72	0.38
2007	182	0.0005	70	0.31

Table Q5. Minimum population abundance and biomass (mt) indices and stratified mean catch per tow, in kg and numbers, for SNE-MAB windowpane flounder caught during NEFSC fall research bottom trawl surveys, 1975-2007. Indices include offshore strata 1-12 and 61-76 and inshore strata 2-46 and 55. Standardization coefficients were applied for trawl door changes (numbers = 1.54 and weight = 1.67), gear changes (numbers = 1.67 and weight = 1.37), and vessels (numbers = 0.82 and weight = 0.80).

Year	Minimum population abundance	Minimum population biomass (mt)	Mean kg per tow	Mean number per tow
1975	8,372,202	1,415	0.46	2.72
1976	10,932,160	2,159	0.70	3.56
1977	13,276,918	2,803	0.91	4.32
1978	10,827,942	2,151	0.70	3.52
1979	23,697,517	4,966	1.62	7.71
1980	14,494,027	3,805	1.24	4.71
1981	15,630,898	3,842	1.25	5.08
1982	29,268,737	5,892	1.92	9.52
1983	13,636,917	3,212	1.04	4.44
1984	11,795,419	2,832	0.92	3.84
1985	12,429,030	2,082	0.68	4.04
1986	10,711,426	1,911	0.62	3.48
1987	7,811,145	1,244	0.40	2.54
1988	7,447,457	1,293	0.42	2.42
1989	4,355,033	667	0.22	1.42
1990	3,918,792	722	0.24	1.27
1991	5,574,295	1,012	0.33	1.81
1992	4,859,523	865	0.28	1.58
1993	2,102,197	382	0.12	0.68
1994	3,406,616	661	0.22	1.11
1995	6,018,837	1,007	0.33	1.96
1996	5,151,888	816	0.27	1.68
1997	2,221,786	446	0.15	0.72
1998	4,054,061	702	0.23	1.32
1999	3,353,123	596	0.19	1.09
2000	3,260,895	552	0.18	1.06
2001	5,387,686	1,248	0.41	1.75
2002	6,140,271	1,188	0.39	2.00
2003	5,819,930	1,075	0.35	1.89
2004	2,870,461	511	0.17	0.93
2005	2,783,458	556	0.18	0.91
2006	4,103,557	805	0.26	1.33
2007	3,884,360	586	0.19	1.26

Table Q6. AIM model input data including NEFSC fall survey minimum population biomass indices (mt) and three-year moving averages of the relative exploitation rate (catch / NEFSC fall survey minimum population biomass index) during 1975-2007.

Year	Minimum population biomass (mt)	Relative exploitation rate
1975	1,415	
1976	2,159	
1977	2,803	0.58
1978	2,151	0.80
1979	4,966	0.52
1980	3,805	0.42
1981	3,842	0.43
1982	5,892	0.80
1983	3,212	1.04
1984	2,832	1.15
1985	2,082	1.81
1986	1,911	1.99
1987	1,244	2.29
1988	1,293	2.92
1989	667	4.33
1990	722	6.04
1991	1,012	4.94
1992	865	1.31
1993	382	1.16
1994	661	1.85
1995	1,007	0.71
1996	816	0.73
1997	446	0.45
1998	702	0.80
1999	596	0.90
2000	552	0.43
2001	1,248	0.23
2002	1,188	0.25
2003	1,075	0.38
2004	511	0.41
2005	556	0.44
2006	805	0.74
2007	586	0.60

Table Q7. AIM model estimates (1975-2007) of the F_{MSY} proxy and the NEFSC fall survey catchability coefficient (*q*), and the probability value for the randomization test for SNE-MAB windowpane flounder.

	Point estimate (90% CI)	Bootstrap mean
F_{MSY} proxy	0.48 (0.46, 0.61)	0.45
NEFSC fall survey *q* (SE)	0.318 (0.081)	
Randomization test *p* value	0.002	

Table Q8. Biological reference point estimates for SNE-MAB windowpane flounder and stock status for 2007. Relative F for 2007 is the catch in 2007 divided by the average minimum population biomass index during 2005-2007 and the minimum biomass index for 2007 is the average index during 2005-2007.

2007 Relative F	F_{MSY} proxy
0.60	0.48
2007 Minimum biomass index (mt)	**B_{MSY} proxy (mt)**
649	1,000

Table Q9. Stochastic projections of catch (mt) and minimum population biomass (mt) in 2009, assuming the 2008 catch and minimum population biomass are both averages for 2005-2007 with the appropriate F applied for each of the three scenarios, for SNE-MAB windowpane flounder. Projections were run out to 2014 as specified in the rebuilding plan.

2008			2009	
Catch (mt)	Minimum Population Biomass (mt)	F 2009	Catch (mt)	Minimum Population Biomass (mt)
362	604	F_{sq} (= 0.60)	337	562
311	648	F_{MSY} (= 0.48)	311	648
272	690	$F_{rebuild}$ (= 0.39)	289	734

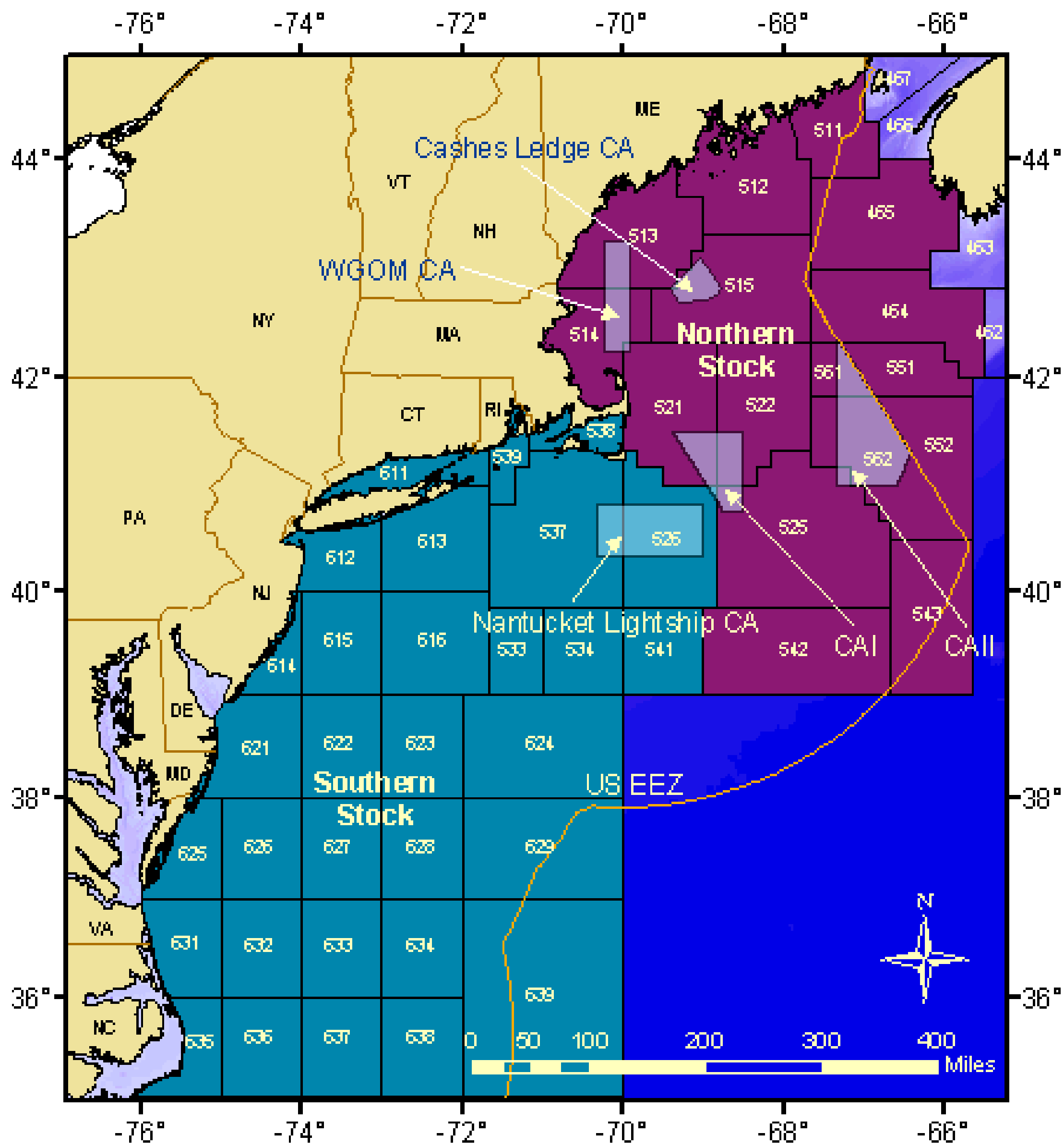


Figure Q1. Statistical Areas comprising the northern (Gulf of Maine-Georges Bank) and southern (Southern New England-Mid-Atlantic Bight) windowpane flounder stocks.

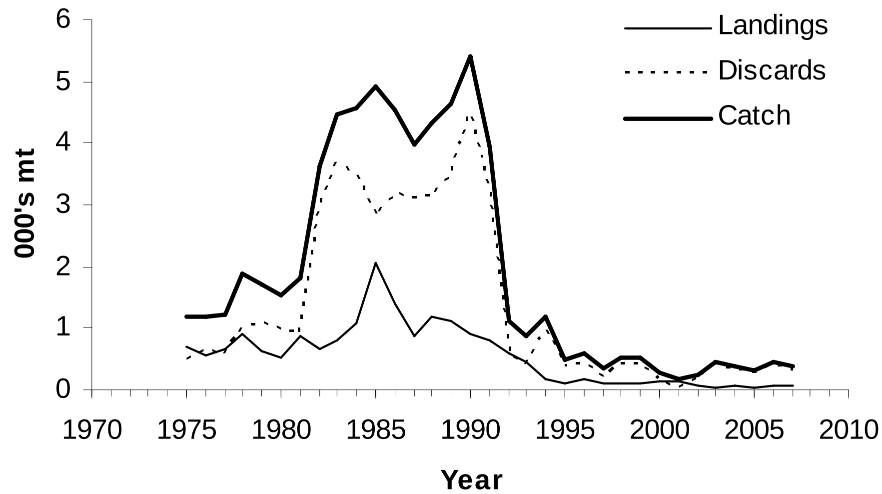


Figure Q2. Commercial landings, discards and catches of Southern New England-Mid-Atlantic Bight windowpane flounder during 1975-2007.

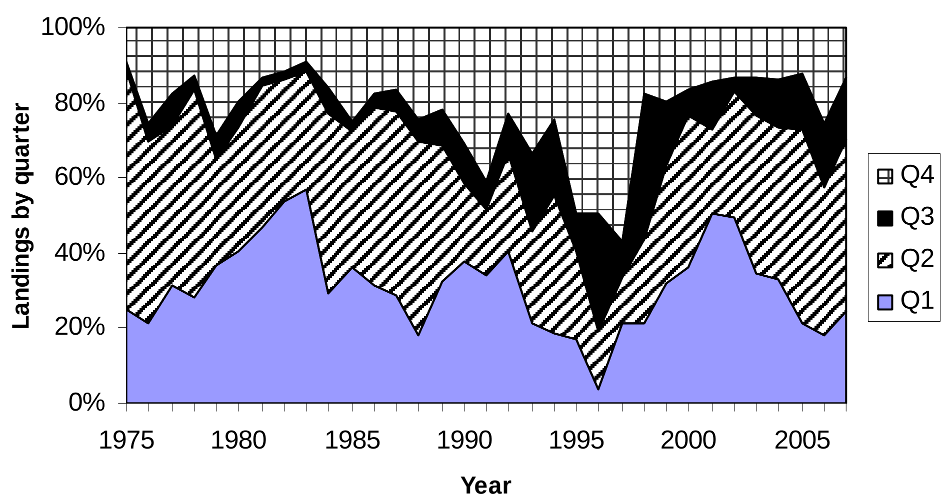


Figure Q3. Percentage of landings of SNE-MAB windowpane flounder, by quarter, during 1975-2007.

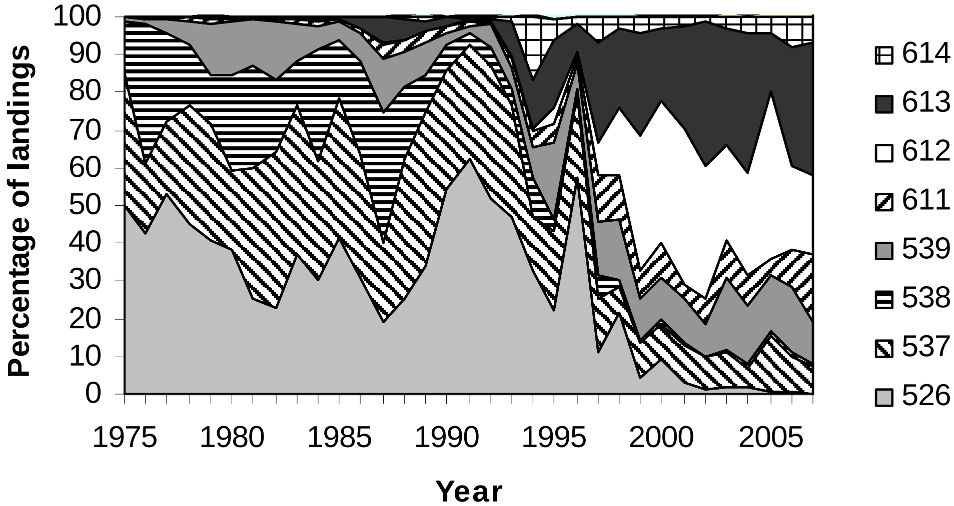


Figure Q4. Percentage of landings of SNE-MAB windowpane flounder, by Statistical Area, during 1975-2007.

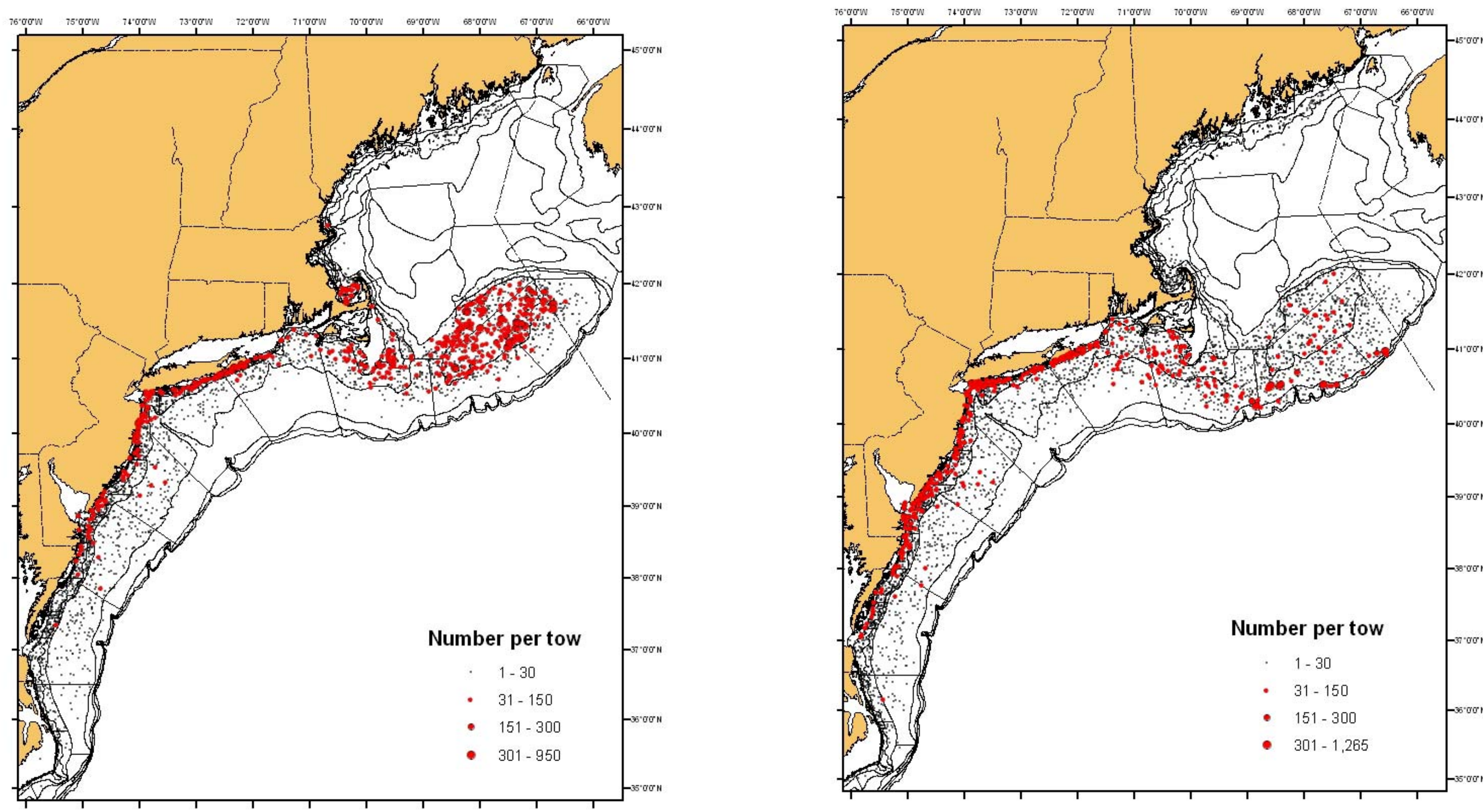


Figure Q5. Spatial distribution of windowpane flounder during NEFSC fall and spring bottom trawl surveys, 1968-2007.

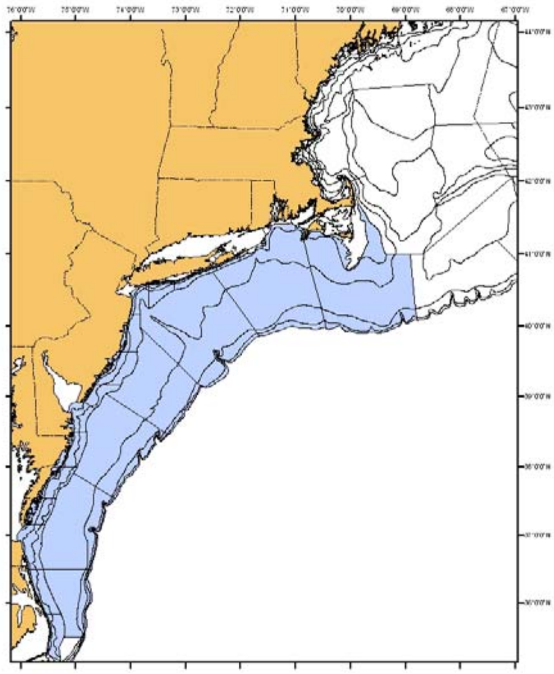


Figure Q6. Strata set used to derive abundance and biomass indices, from NEFSC fall and spring bottom trawl surveys, for the SNE-MAB windowpane flounder stock.

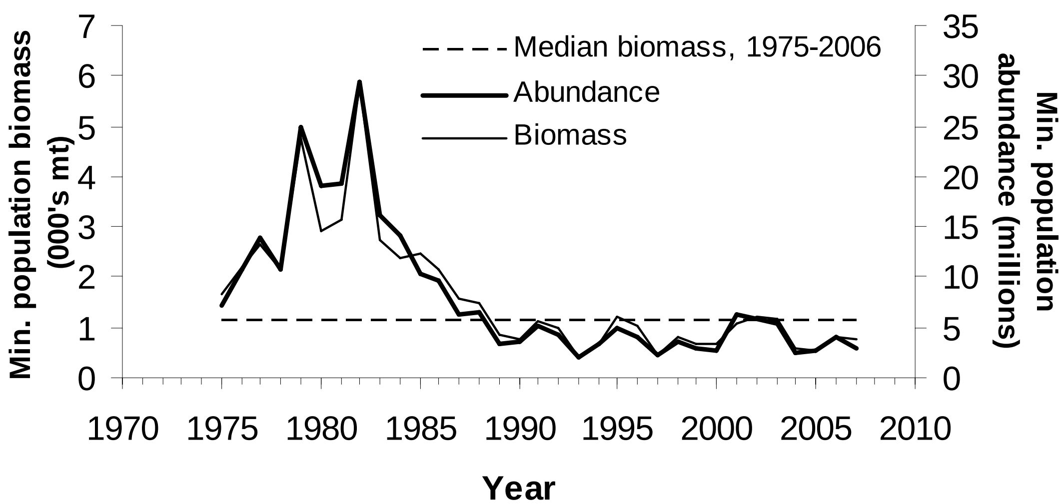
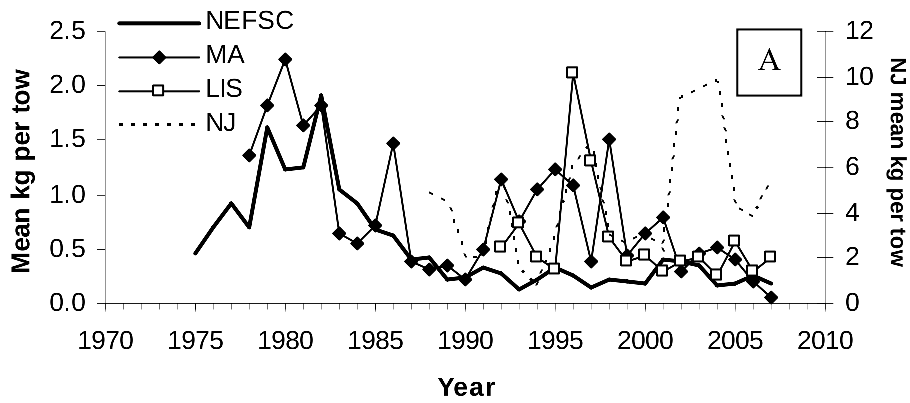


Figure Q7. Minimum population abundance (millions) and biomass indices (000’s mt) for SNE-MAB windowpane flounder caught during NEFSC autumn bottom trawl surveys conducted during1975-2007.



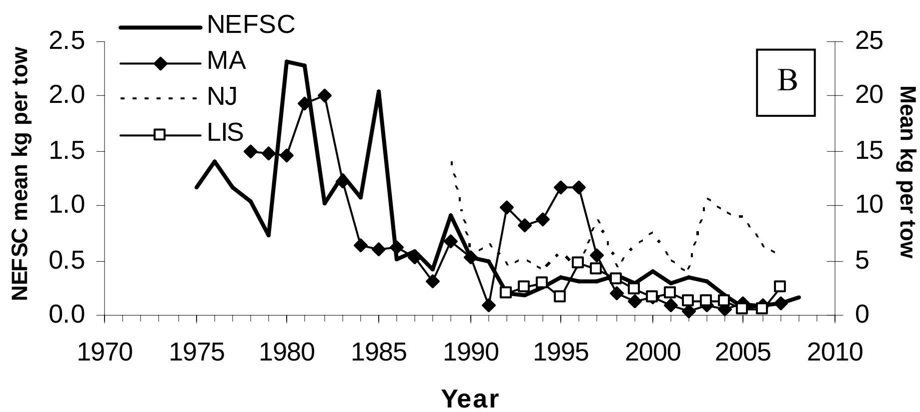


Figure Q8. Relative biomass indices for SNE-MAB windowpane flounder caught during (A) fall surveys conducted by the NEFSC, MA, NJ, and CT (= LIS) and (B) spring surveys conducted by the NEFSC, MA, NJ, and CT.

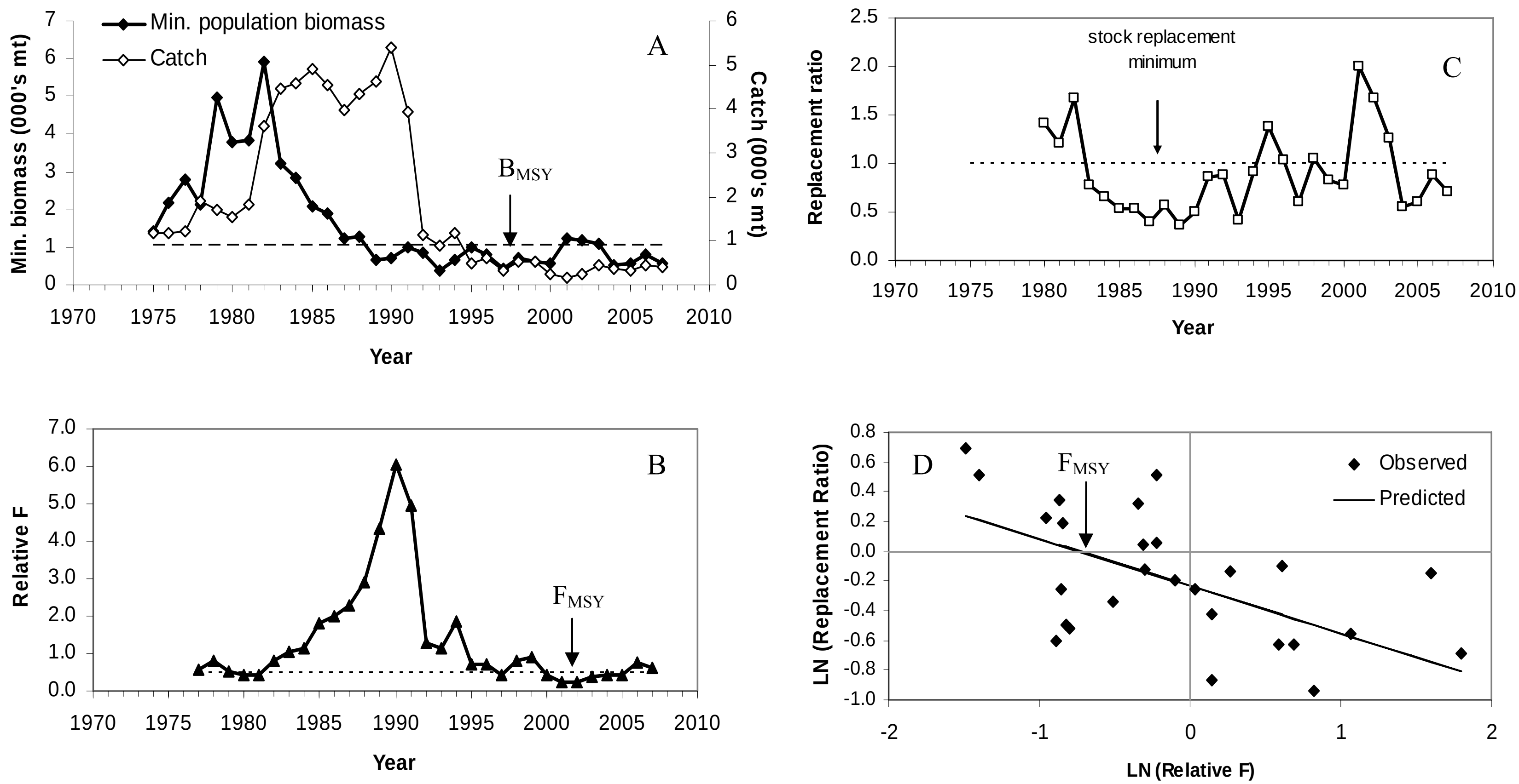


Figure Q9. Trends in (A) SNE-MAB windowpane flounder catches (000's mt) and NEFSC fall survey minimum population biomass indices (mt), (B) relative exploitation rates (catch/fall survey biomass index), (C) stock replacement ratios, and (D) the regression of ln(relative F) against ln(replacement ratio) to calculate the relative F value where ln(replacement ratio) is equal to 0 (= F_{MSY} proxy of 0.48) during 1975-2007.

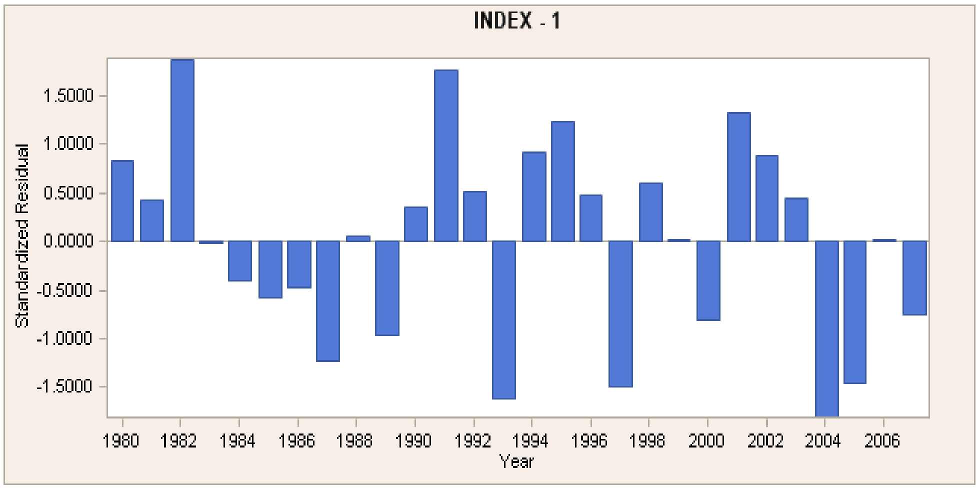


Figure Q10. Standardized residuals from the final AIM model run for SNE-MAB windowpane flounder.